Space-related Content-Management

VOIGT Andreas, SCHMIDINGER Elmar, WALCHHOFER Hans Peter, LINZER Helena

Vienna University of Technology, Institute of Local Planning, Austria
voigt@ifoer.tuwien.ac.at, www.ifoer.tuwien.ac.at

Establishing virtual city models ("digital cities") has become an important planning tool for configuring the future of our cities and vital spaces. The present contribution discusses the concept of "Space-related Content-Management" and its interlaceable possibilities of implementation in the planning and configuration process. The activities of those acting in space and their impacts on space, e.g. leading to new, additional and renovation of buildings, to the demolition of buildings, to alterations regarding vegetation stock, traffic infrastructure, etc., do not result from a static conception of physical space, but exclusively suggest a dynamic one. Real space is subject to continuous changes. The constant changing of physical space thus represents a considerable factor concerning the conception of the virtual image (virtual city model). The dynamics of space suggests the development of "data-pipelines" as core elements of virtual city models. Only this pipeline-concept can account for the dynamics of space. It is suggested to embed "data-pipelines" in "Content-Management-Systems (CMS)" thus promoting the concept of "Space-related Content-Management" including all kinds of space-related information enriched with metainformation that might be useful during the planning- and configuration process. "Space-related Content-Management-Systems (SCMS)" are considered as navigation systems through complex space-related data sets supporting a broad range of questions during the planning- and configuration process. The application fields of "Space-related Content Management-Systems" are supposed to integrate the complete planning process starting with the space-related analysis and model generation via characterization of space and winds up at the development of space-related concepts to be passed on to those involved in the space under consideration.

***Keywords**: Space-related content-management, space-related modeling and simulation, digital cities, VR city models, space related quality management*

Space & Time – "Data-pipelines"

Real space is subject to continuous changes. The dynamics of space suggests the development of "data-pipelines" as core elements of virtual city models. The term "data-pipeline" stands for the procedural flow of the space- and time-related data of various sources. The "data-pipeline" is a system aiming at automate generation of 3D-city models suited for interactive walkability and simulation of these models.

Based on the experience of numerous projects applied in industry and research activities

regarding space-related model generation and simulation mainly three difficulties concerning visualizing of complex 3D-models (also applying to city models) are to be considered:

- reduction (optimization) of the complexity of geometry,
- administration of the complex models in a structured way,
- and interactive representation of the models.

The concept "data-pipeline" is to take all three aspects into account by combining three application environments providing sufficient transparency regarding data-exchange and format and granting suited scaling regarding data size.

The "data-pipeline" leads through suited comprehension- and analysis processes via the database directly up to interactive visualizing and simulation systems. Source-data for this system are surveying data of building ground plots, eaves and heights thereof, data of terrain, vegetation and more. The data are automate-processed in an object-oriented way and combined to an entire complete 3D-city scenario. The complex data set is processed in a database and interactive (lending itself to real-time) models generated via query-call criteria (e.g. fields).

The "data-pipeline" features mainly 3 core-areas supplemented by a "staging area" and "editing and modeling tools":

A) Import and converting, data optimizing (graphic toolbox): Optimizing is performed in an environment also used throughout the automobile industry, the "digital mockup" (dmu). This environment serves the reduction of complex scenarios.

B) Database-management (database): Due to the great number of objects and the possibility of subsequent processing (reviewing and increasing the degree of detailing) a database is indispensable. Furthermore, in its extension such a database could be linked with statistical information or any other decisive space-related information stored in GIS.

C) Interactive representation, visual simulation: Regarding interactive representation the visualizing system is to account for the degrees of complexity to be furnished.

It is suggested to embed "data-pipelines" in "Content-Management-Systems (CMS)" thus promoting the concept of "Space-related Content-Management" including all kinds of space-related information enriched with metainformation that might be useful during the planning- and configuration process.

Basic Functions of Content-Management-Systems (CMS)

Basic functions of "Content-Management-Systems CMS)" consist of the compilation, management, availability and archiving of information. The following questions are to be linked with the individual functions amongst others:

Capturing information

- data capture for various uses and groups of users, definition of data quality
- metadata: description of data, of data origin (author), the capturing data, etc.
- rights: property, copyright, etc.

Information management

- processing: workflows, roles, rights
- updating and versionizing (all existing versions of data to be preserved)
- variants: processing steps, planning variants

Making information available

- differing user groups: data capture, correction and resolving issues can be supported by various user groups
- differing requirements, availability of data in line with the specific utilization

Archiving information

- data migration / data maintenance: translation of data into new versions and formats

Concept of Space-related Content-Management-Systems (SCMS)

"Space-related Content-Management-Systems (SCMS)" are considered as navigation systems through complex space-related data sets supporting a broad range of questions during the planning and configuration process.

"Data-Pipelines" (cf. above) represent the core of SCMS (data import – converting and optimizing, database-management, interactive representation / visual simulation). SCMS link the information available (planning-specific space-related information, metainformation) and make them available as "Rich-Media": they administer and archive various versions and establish relations between existing modules (GIS, database, etc.). Subject queries generate appropriate models and simulations. An export-module makes for data exchange, quality check, the XML-export and the connection to special simulation modules amongst others (visual simulation in CAVE, GIS-based simulations, complex spatial simulations, etc.). Linking of the SCMS-objects with existing services of other modules (GIS, database, etc.) is achieved via 3D-object-IDs (identity characteristics). Access to SCM-data should be possible via links / URL´s.

SCMS are to meet following requirements:

Management of comprehensive, complex datasets

- 2D- and 3D-geometry
- mages, texts, other documents
- video/audio, simulation data, metadata, etc.

Dealing with the time dimension of 3D-objects

- dynamics of space
- versionizing

Interactivity

- subject queries
- nteraction with models (modification, navigation, preferably in real time)

In order to grant networking and integration of information and linking of different modules the following frame conditions are to be established:

Information reference to 3D-object-ID (identity characteristics)

- all data types referring to the 3D-Objekt-ID

Providing the object referencing

- from and to other modules / systems (databases, GIS, CAD, visual simulation, etc.)

Levels of Detail (LOD´s)

On viewing "space" and preparing for activities using development planning to preserve or change the spaces in their physical structure or their possibilities for using we always utilize models with differing spatial degrees of resolution (scales, grids, detailing degrees). Variation of an abundance of details is aimed at in modeling of urban space: different "levels of detail, LOD" can be distinguished.

These "LOD´s" act as auxiliary constructions in handling complex, large datasets on the one hand (provided the entire model is to be visualized the more distant objects are to receive the least resolution, whereas those near to the viewer are to issue a degree of complexity as high as possible; in line with meaningful management of these effects the data are to be structured and developed accordingly, i.e. various levels of detail, LOD); on the other hand the various LOD´s represent the different finalization forms of space in the planning process (from the abstract "city volume" to the concrete architectural building).

In this context the "city and building-up volume" is to be considered as a key figure throughout the urban spatial configuration process: Configuration of urban space and its space sections is significantly influenced by the securing and further development of the "city and building-up volume". In the long run the building-up volume acts as the defined three-dimensional scope of reference and action regarding constructional-spatial development, specifying the interaction between material three-dimensional elements and

free areas throughout the settled area.

Following LOD´s can be distinguished amongst others (comp. Bourdakis, 2001):

- "0-model"
- "volume model"
- "detail model"
- "architecture model"
- etc.

If the various "LOD´s" are to be put to meaningful use for planning purposes it is decisive which „volume" is modeled. Following approaches may prove interesting: gross cubic capacity, urban spatial volume, energetic volume etc. Various referential heights are to be considered: the eaves height, the lowest point of intersection of the building with the ground, the authorized permissible referential height, the basement bottom, etc. Various forms of building parametrification seem feasible in this context.

Applications Fields of SCMS

The question as to which data should actually be integrated in the model depends on the type of utilization, the structure of user groups and the users' requirements. Establishing an ideal basic data set well suited for the entire planning-, decision-and communication process regarding spatial issues as well as the specifically required variety of detail and the validitation of simulation techniques call for further research in the field of planning sciences in connection with environmental psychology (comp. Markelin, Fahle, 1979, Keul, Martens, 1995)

The application fields of "Space-related Content Management-Systems" are supposed to integrate the complete planning process (comp. Schönwandt, 1999) starting with the space-related analysis and model generation via characterization of space and winds up at the development of space-related concepts to be passed on to those involved in the space under consideration.

References

Bourdakis, V.: 2001, On Developing Standards for the Creation of VR City Models in Penttilä, H. (ed.): Architectural Information Management [Proceedings 19th eCAADe-Conference, Helsinki (Finland)], Helsinki, pp. 404-409

Day, A.K. and Radford, A.D.: 1998, An Overview of City Simulation in Sasada, T. et al. (eds., 1998), [Proceedings 3rd CAADRIA-conference Osaka], pp.183-192

Dokonal, W. and Martens, B.: 2001, A Working Session on 3-D City Modeling in Penttilä, H. (ed.): Architectural Information Management [Proceedings 19th eCAADe-Conference, Helsinki (Finland)], Helsinki, pp. 417-422

Keul, A. and Martens, B.: 1995, Simulation – How Does it Shape the Message? in Martens, B. (Ed., 1995): The Future of Endoscopy [Proceedings 2nd EAEA-Conference 1995]. Wien: Österreichischer Kunst- und Kulturverlag, pp. 47-54

Markelin, A. and Fahle, B.: 1979, Umweltsimulation. Sensorische Simulation im Städtebau. Schriftenreihe 11 of Städtebauliches Institut, Universität Stuttgart. Stuttgart: Karl Krämer Verlag

Schönwandt, W.: 1999, Grundriß einer Planungstheorie der „dritten Generation" in DISP 136/137, ETH Zürich, pp. 25-35

Voigt, A. and Linzer, H.: 1999, The Digital City, in Bermudez, J. et al. (eds.), [Proceedings sigradi-Conference, III Congreso Iberoamericano de Grafico Digital, Montevideo (Uruguay), 29 September – 1 October 1999], Montevideo, pp. 438-442

Voigt, A., Walchhofer, H.P., Linzer, H.: 2000, City Experimental Lab, in Ripper Kós, J., Pessoa Borde, A., Rodriguez Barros, D. (eds.), [Proceedings sigradi-Conference, IV Congreso Iberoamericano de Grafico Digital, Rio de Janeiro 09/2000], Rio de Janeiro, pp. 143-146